Transportation and logistics cluster competitive advantages in the U.S. regions: A cross-sectional and spatio-temporal analysis

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ABSTRACT

This article applies spatial cluster and econometric analyses to study attributes of the transportation and logistics cluster regions across the continental U.S., focusing on jobs, clustering, and dispersal patterns. Two questions are examined: 1) Is transport and logistics specialization a primary feature of large urban metropolitan regions or do rural nonmetropolitan regions (be they micropolitan or noncore) have the capacity to support this type of cluster? 2) Does transport infrastructure explain jobs in the transportation and logistics cluster? The research employs a county level lattice data of transportation and logistics cluster jobs from 2008 to 2012 as well as transport infrastructure variables. The findings reveal that the transportation and logistics clusters are concentrated primarily in metropolitan areas, and to some degree, in nonmetropolitan regions of the U.S. In addition, the transport infrastructure is found to have a positive impact on jobs in the transportation and logistics clusters over the period of the study. Intermodals have the largest effect on jobs, followed by airports, annual average daily traffic on the National Highway Planning Network, railroads, and ports.

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1. Introduction

A growing number of U.S. regions are pursuing specialization in transportation and logistics services as a way of strengthening their competitiveness in the national and global markets. Easy access to various modes of transport, cost effective transportation services, and efficient logistics are instrumental in enhancing the comparative advantages of the regions. These advantages include improved labor accessibility and mobility, expanded employment markets, greater access to intermediate goods and commodities, and to some extent, increased productivity Rodrigue, Comtois and Slack (2013), ECMT (2002), Berechman and Paaswell (2001), Federal Highway Administration (2001). Clustering of firms can benefit from Marshallian advantages, such as external and internal economies of scale as a result of agglomeration and localization processes Kadokawa (2011a) and Rivera, Sheffi, and Welsch (2014). Kadokawa (2011a,b) notes the network benefits that can accrue to firms due to clustering. Furthermore, Rosenthal and Strange (2004) found that the gains associated with clustering include natural endowment, local demand and market size, consumption, and rent opportunities. Clustering can also facilitate vertical and horizontal integration whereby firms are positioned to expand their activities to suppliers and distributors and grow existing production within the enterprise. Mamberg and Maskell (2002) and Sheffi (2013) reveal that competition within the similar firms (horizontal dimension) and collaborations with the suppliers, distributors, and trade partners (vertical dimension) serve as conduits for knowledge diffusion and efficiencies within the cluster.

A number of researchers have presented "geographic concentration" and "spatial clustering" as agglomeration processes including some (Alecke, Alsleben, Scharr, and Untiedt, 2006) using these terms synonymously and some (Rosenthal and Strange, 2004) alluding to "spatial concentration" as a means to achieve economies of scale. Research by Sheffi (2012), Rodrigue et al. (2013), and Rivera et al. (2014) reveal that transport and logistics related firms co-locate and concentrate geographically in order to benefit from the agglomeration and localization economies. According to Sheffi (2012 and 2013), a logistics intensive cluster could be an agglomeration of diverse logistics-related companies, third-party logistics (3 PL) providers, transporters, carriers, distributors, warehousing, truck and rail terminals, ports and airports, logistics-related institutions, allied manufacturing, specialized IT (information technology), high- and low-skilled workforce, and other support services.

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Industry clusters are not a new economic development strategy for regions. According to Waits (2000), early adopters of industry cluster-based economic development strategies included Arizona, Florida, Massachusetts, and Illinois, with much of this occurring during the period of the 1990s. With the growing acceptance of clusters in the early 2000s, the National Governors Association sponsored a study on a guidebook to promote cluster-based economic development and cluster-focused strategies for services, investments, and workforce development in the U.S. states Rosenfeld (2002). In this context, industry clusters are defined as geographical concentrations of competitive and complimentary firms that purchase and sell from each other, share labor pools and supply chains, employ similar technologies and skills, provide support services and specialized infrastructure, and create both high and low value-added employment Unlocking Rural Competitiveness (2007), Nolan and Kumar (2006), Hill and Brennan (2000). Industry clusters can produce goods and services for exports outside the host region. More importantly, clusters can share, adapt, leverage, and accelerate innovation Unlocking Rural Competitiveness (2007), Nolan, Morrison, Kumar, Galloway, and Cordes (2011), Nolan and Kumar (2006).

Porter's (1990) seminal work on competitiveness brought attention to business and industry clusters as a principal regional economic development strategy Porter (1990) and Sheffi (2012). Industry clusters and select member industries are considered as the drivers of a region's economy, including states, multi-county, metropolitan, or city-regions Waits (2000) and Hill and Brennan (2000). In contrast to other types of industry clusters, transportation and logistics is a unique cluster given the additional "catalytic" role it plays Sheffi (2012). As noted by Sheffi (2012), a region that is specialized in transportation and logistics can support other types of clusters that can benefit from efficient and rapid movement of goods and services. His research finds that the capacity of logistics cluster to serve other industry clusters proves advantageous not only for the logistics businesses themselves, but also for the host region Sheffi (2012). Sheffi (2012) identifies a number of strengths linked to logistics clusters. For example, logistics jobs are mostly local and place-based and hence, are not easily replaced by offshore jobs. Additionally, logistics clusters provide opportunities to train and develop skilled workforce internally. Furthermore, logistics services serve diverse industries and as a result, are more resilient to the recession shocks Sheffi (2012).

This study explores spatial patterns of transportation and logistics cluster in the U.S. regions by utilizing a Geographic Information System (GIS) based county level dataset of economic attributes of transportation and logistics cluster for the 2008 to 2012 period. It attempts to identify regions of concentration or specialization, and explores the following two questions: 1) Is transport and logistics specialization a primary feature of large urban metropolitan regions or do rural nonmetropolitan regions (be they micropolitan or noncore) have the capacity to support this type of cluster? 2) Does transport infrastructure explain jobs in the transportation and logistics cluster? The objective is to study the spatial distribution patterns of the clusters and explain the relationships between cluster jobs and transport infrastructure variables, such as highways, railroads, waterways, and airports. For the present study, the term "specialized" is generally defined by employment location quotient (LQ) values greater than 1 with a threshold value of 1.2. The employment LQ measures concentration of jobs in the transportation and logistics cluster with respect to the national average.

The article makes the case that transportation and logistics clusters can be considered a viable regional development planning option for rural nonmetropolitan regions. While it is an accepted fact that transportation and logistics is an urban and metropolitan phenomenon, it can be argued that it exists to some degree, in nonmetropolitan regions of the United States as well.

The remaining sections of this article are organized as follows. We begin with a review of the pertinent literature and move into a discussion of the methodological framework employed in our study. Next, we focus attention on the specialization patterns in urban and rural areas, doing so for the purpose of investigating the first research question. We then examine cluster and transport infrastructure intensity, an analysis that allows us to explore the second research question. In the last section of the article, we highlight the key findings and outline the potential policy implications associated with our research.

2. Literature review

A number of studies have been undertaken on business and industry clusters, including ones focused on methodologies for defining clusters, the pros and cons of pursuing cluster-based economic development strategies, and in-depth examination of specific industry clusters. At the same time, a limited number of studies have focused on transportation and logistics clusters in the U.S., their role in advancing the economic development of regions, the variety of industries that constitute these clusters, and details about their life cycle. One exception is the works by Yossi Sheffi, Jean-Paul Rodrigue, and their research collaborators who have contributed extensively to this area Sheffi (2012) and Rodrigue et al. (2013). The present review covers the literature on methodologies for defining the industry clusters; spatial analysis of the industry clusters; rural economic base and industry clusters; role of public policies; and finally, a select set of studies targeting transportation and logistics clusters.

At the outset, it is important to note that in addition to Porter's key contribution in delineating the forces shaping the competitiveness of regions, Krugman's seminal contributions in new economic geography has provided insights on economic processes behind formation of the industry clusters. Krugman's (1991) core periphery theory explains why manufacturing concentrates at certain locations and opportunities for increasing returns because of the localization and urbanization externalities. Krugman (1991, 2009) draws on Myrdal's "circular causation" and Arthur's "positive feedback" to explain agglomeration benefits and identifies the important role of transportation in the new economic geography and new trade theories.

2.1. How industry clusters are defined?

Analysis of backward and forward linkages or inter-industry flows in national and regional input output tables has been used to identify industry clusters by several researchers dating back to the 1970s. Roepke, Adams and Wiseman (1974), Czamanski and Ablas (1979), and O hUallachain (1984) researched a variety of ways to analyze transactions matrices of the input output table and derived groupings of industries interconnected through flows of goods and services. Czamanski and Ablas (1979) classified various methodologies for identifying industry clusters and complexes broadly into multivariate analysis, graph theory, and descriptive studies. Such benchmark cluster definitions were applied to geographical regions to identify specific concentration of industries and businesses, thus providing a spatial context Czamanski and Ablas (1979) and Hofe and Chen (2006). According to Hofe and Chen (2006), statistical analysis of input output tables has continued to be applied in contemporary research on industry clusters. Bergman and Feser (1999), for example, provided a detailed discussion of input–output analysis for cluster